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STORAGE

PLATYEDRA GOSSYPIELLA, SAUND.,

THE PINK BOLL-WORM, IN SOUTH INDIA 1920-1921

BY

E. BALLARD, B.A., F.E.S

Government Entomologist, Madras

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PLATYEDRA GOSSYPIELLA, SAUND., THE PINK BOLL-WORM, IN SOUTH INDIA, 1920-1921.

BY

E. BALLARD, B.A., F.E.S.,

Government Entomologist, Madras.

[Received for publication on 4th March, 1922.]

THE investigations into the habits of the Pink Boll-worm for the season 1920-21* were a continuation of those started in 1919.[1] They were designed to act as a check on last season's observations and to find if possible some means of calculating in terms of rupees the actual loss likely to be sustained by the *raiyat*. From this should follow some results which would show the extent to which the Pest Act had benefited cotton growers in those districts in which it has been enforced. As was the case last year, no signs of long-cycle larvæ being produced were found, and the infestation of the new crop must come simply from survivors of the last generations produced in the previous year. The problem of how the Pink Boll-worm tides over the dead season even to the small extent of which it is now capable has yet to be elucidated. This paper only gives figures of the rate of increase once the first infestation of the crop has started.

Measurements were made of all larvæ found in cotton bolls. These were grouped under three heads : those under 5 mm. in length, those between 5 and 10, and those over 10 mm. The percentage of these to one another at any time should give an indication of the rapidity with which broods

* All notes on the Pink Boll-worm and *Earias* spp. refer only to the southern districts of the Presidency as practically no work has been done on these pests in the northern cotton tracts.

[1] Ballard, E. "Results of Investigation of Bionomics of *Platyedra gossypiella* (Saunders) in South India." *Proceedings 4th Entomological Meeting, Pusa*, pp. 70–82, t. 13–15 (Dec. 1921).

succeeded one another. A high percentage of –5 larvæ would show that there had recently been a fresh brood and so on. It seemed last year at one time (27th March–8th May) that the length of the larval life was somewhat prolonged, the majority of boll-worms found in green bolls for these five weeks being between 5 and 10 mm. in length, while later on the generations overlapped considerably; from this it seemed that the larval life during the second part of the season (June–August) was shorter. These observations have not been confirmed by the measurements taken this year (1920-21); no such preponderance of +5 larvæ being found between the same dates. It will be seen from Plate XVI, fig. 1, that generations succeeded one another with equal rapidity.[1] Some attention was given to *E. fabia* and *E. insulana* and notes made on the degree of infestation of green bolls and the amount of damage done by them compared to the amount done by the Pink Boll-worm. The results obtained are given in another part of this paper.

Rate of increase in green bolls.

Last season the increase in boll-worm population was calculated from 1,000–2,000 green bolls examined weekly. This year another plan was followed. A field of about 4 acres was placed at my disposal by the Central Farm. The cotton plants in this were divided up into lots of 100 each and all green bolls from one plot were examined weekly, a different plot being taken each week. It was hoped that by this means a fair average for the whole field would be obtained, and at the same time the amount of infestation for Coimbatore District might be estimated, as it was considered to be unlikely that *raiyats'* fields in other parts of the district would be more badly affected.

The plants germinated well, but later on in the season did not flourish and very few bolls were set compared with what might be considered a good average field—many of the plots giving a very uneven yield, the highest number of bolls gathered from any block being only 862 for the "season" and 1,412 for the *kar* or summer picking. Plate XVI, fig. 2 gives the degree of infestation week by week and also the increase in boll-worm population. For the purpose of calculating the latter only actual boll-worms found were counted, and reduced to terms of population per 100 bolls. Plate XVII, fig. 1 gives the same calculations from 1919–20 season. The most striking feature noticed, when comparing the two charts, is that whereas last year, towards the end of the season, *i.e.*, after 8-VII-20, the percentage of population was far higher than the amount of infestation, in this year this was not nearly

[1] *Ballard, E. ibid.*

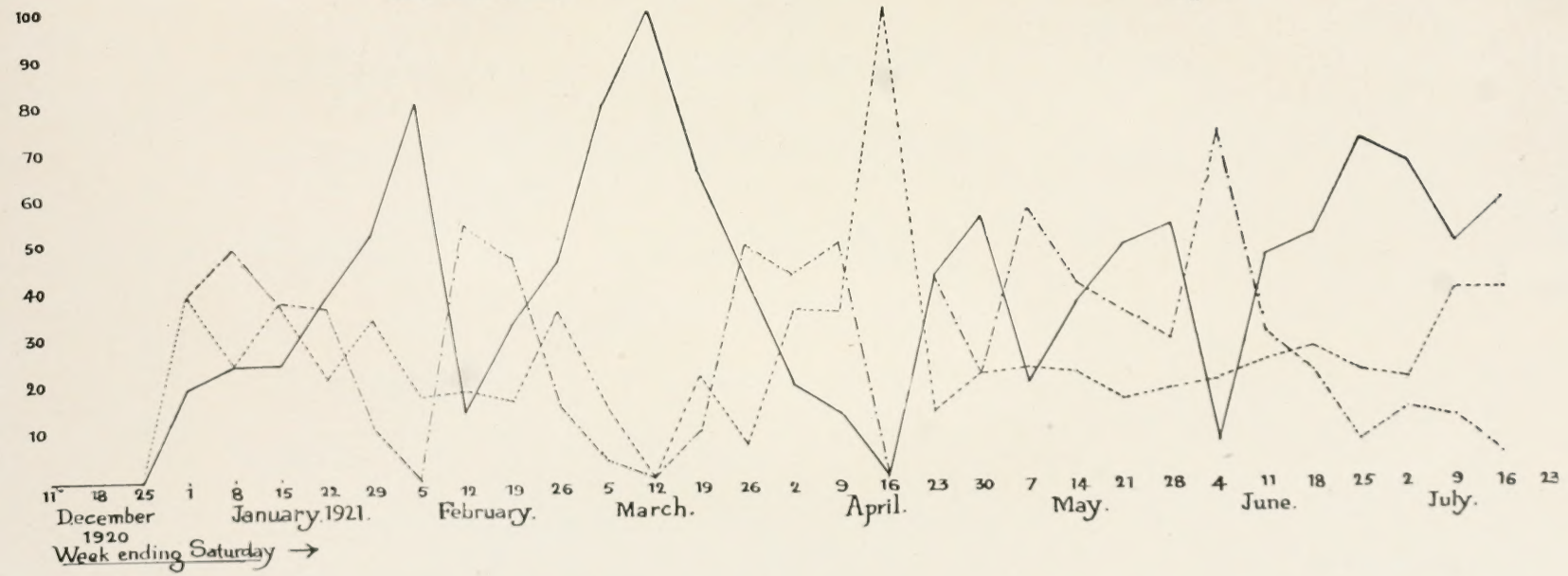
GREEN BOLLS: CAMBODIA COTTON: NEW BLOCK. CENTRAL FARM, COIMBATORE

Relative percentages of Platyedra larval measurements.

Under 5mm{-5} ---- Over 5mm{+5} ..... Over 10mm{+10} ——

SEASON-1920-1921

Fig. 1.



CAMBODIA COTTON NEW BLOCK CENTRAL FARM

Percentage of population in Green bolls

Earias ..... Platyedra ——

Percentage of infestation - - - - - -

SEASON 1920-1921.

Fig. 2.

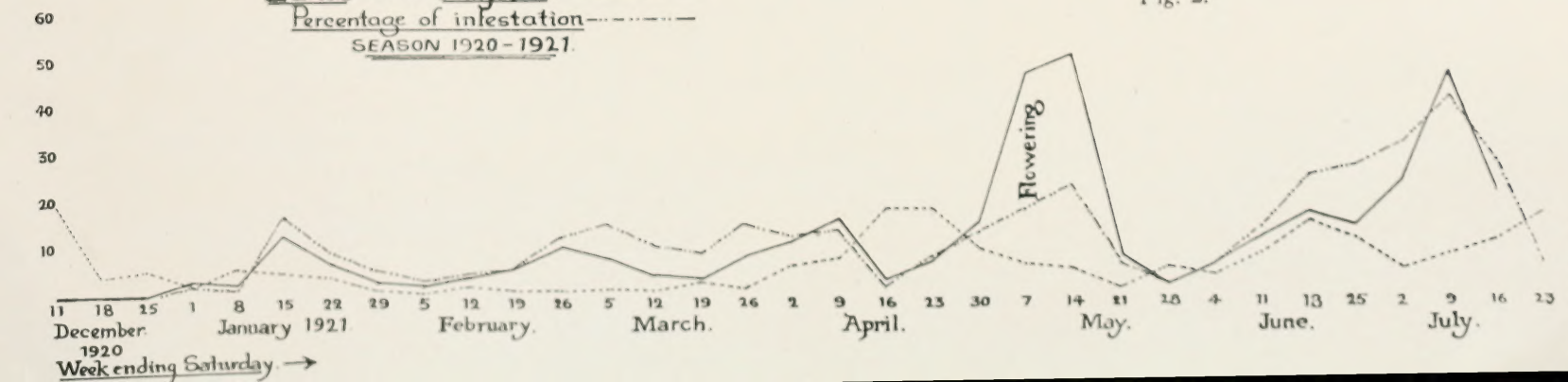


PLATE XVI

so marked, the population keeping about the same figure as the boll infestation. It is higher during the interval between first and second crops and rises again at the end of second crop, just before plants were pulled up. The infestation for the same week (second week in July) in the two years is the same.

TABLE I.

Number of bolls set by plots of 100 *plants and degree of infestation.*

11-XII-20—23-VII-21.

No. of plot	No. of green bolls	Infestation	Actual population *Platyedra*	Date	REMARKS
		(Percentage.)			
1	35	..	..	11–XII–20	Very young bolls not examined.
6	104	..	..	18–XII–20	First *Platyedra* eggs found on 17-XII-20.
12	76	..	..	25–XII–20	
18	205	2·44	5	1–I–21	
24	178	2·24	4	8–I–21	
30	209	16·74	27	15–I–21	
36	405	8·64	27	22–I–21	From this week green bolls of all ages were collected.
42	770	4·41	17	29–I–21	
48	862	2·43	11	5–II–21	9 larvæ 10 mm. in length.
54	556	5·57	22	12–II–21	
60	709	5·53	39	19–II–21	
66	354	12·14	36	26–II–21	
72	343	14·86	26	5–III–21	
78	235	10·21	9	12–III–21	All larvæ + 10 mm.
84	340	8·82	9	19–III–21	
90	169	14·79	14	26–III–21	
96	255	12·15	30	2–IV–21	
112	195	13·09	14	9–IV–21	84 examined as remainder were eaten by rats.
118	118	1·53	2	16–IV–21	53 bolls eaten by rats. 65 examined.
124	101	7·92	7	23–IV–21	
130	114	13·15	18	30–IV–21	
136	124	17·74	60	7–V–21	34 —5 mm. Maximum number in one boll 11, 10 of which were —5 mm.
142	148	22·97	76	14–V–21	Maximum in one boll 8.
148	648	5·55	51	21–V–21	Maximum in one boll 6.
154	869	2·18	17	28–V–21	
160	1,412	6·30	92	4 –VI–21	69 larvæ—5 mm.
166	604	15·06	71	11–VI–21	
172	343	24·78	59	18–VI–21	
184	593	32·37	140	2–VII–21	92 larvæ +10 mm.
190	300	41·33	141	9–VII–21	Maximum number in one boll 7.
196	106	27·33	23	16–VII–21	Maximum number in one boll 6.
202	108	9·26	7	23–VII–21	Plants all pulled up by 1st August.

After 4-VI-21 young and formed bolls were examined separately. It has been noted that the boll-worm avoids young bolls but prefers those

three-quarters to fully grown. The figures given below support this observation.

TABLE II.

Showing boll-worm population in young bolls and bolls ¾ to fully grown.

Number of bolls	¾ to fully grown	Young	Population	
	a	b	a	b
1,412	470	942	17	3
604	353	251	68	4
349	287	62	56	3
377	357	20	55	..
593	568	25	140	..
300	288	12	141	..
106	57	49	19	4
108	35	73	3	4

DAMAGE TO WHOLE CROP FROM EXPERIMENTAL AREA.

As the crop in the experimental area ripened and picking began, counts were made of the actual damage sustained by the crop. At first the ripe bolls were picked whole from the bushes and brought into the Insectary for examination ; later it was found that some were lost and in other cases the *kapas* separated from the capsule. Examination was then made in the field as the crop was picked.

One boll-worm only eats two or three seeds, therefore, as a rule, would only damage one locule, or one lock so far as the destruction of seed is concerned. But in addition to this, the lint is often stained, fungus spores get in through the escape hole made by the mature larva, and threads of the lint are often stuck together. Taking all this into consideration, and also the fact that healthy seeds in an attacked boll are also affected, it was assumed that a locule attacked was to all intents and purposes a locule lost and that its contents were valueless. This is not true in every case and depends on the age of the boll when it was first attacked, but for the purpose of arriving at a rough estimate of the loss to the crop due to Pink Boll-worm it is probably accurate enough. It is calculated that the results obtained give an outside figure and that the actual losses due to Pink Boll-worm fall well inside the estimate made.

In Table III are given the details of examination of ripe bolls from the 4 acres of cotton on the Central Farm, 1920–21. In some ways the figures are unsatisfactory : not only did some stealing of *kapas* take place, but cattle

rom a village just on the boundary of the field, which had been recently acquired, often strayed into the crop and did more damage than many boll-worms. The loss of some *kapas* which fell from the ripe locules also contributes to inaccuracy, but even taking all these factors into consideration the results obtained are not without interest. It may be noted that a boll damaged by *Earias* might at times have been mistaken for one damaged by *Platyedra*, but the effects of the working of the two insects are generally very easily differentiated after a little experience,[1] and it is not likely that very much inaccuracy has crept in owing to the work of the two boll-worms being confused. *Earias* also generally confines its attention to buds and young bolls and in any case is always present in much smaller numbers than the Pink Boll-worm.

TABLE III.

Showing the details of examination of ripe bolls from 4 acres of cotton on Central Farm, 1920-21.

Date	No. of bolls collected	No. of bolls damaged *Platyedra*	No. of locks damaged *Platyedra*	REMARKS
Week ending—				
5–II–21	10,023	4,511	6,300	
12–II–21	8,528	2,692	3,398	
19–II–21	8,596	1,888	2,375½	
26–II–21	13,328	2,369	2,654	
5–III–21	26,904	3,455	3,919½	
12–III–21	25,604	1,728	1,816	
19–III–21	22,469	1,454	1,519½	
26–III–21	11,664	1,071	1,229½	
2–IV–21	8,609	636	730	
9–IV–21	5,340	717	867	
16–IV–21	10,598	2,281	2,102½	
23–IV–21	4,643	1,338	1,346	
30–IV–21	8,050	2,848	3,134½	
7–V–21	3,688	1,504	1,708½	
14–V–21	3,547	1,419	1,665½	
21–V–21	3,693	1,942	2,746	
28–V–21—11–VI–21	Interval between season and *kar* picking.			
18–VI–21	10,970	5,527	9,462	Bolls not picked from West side of field reducing total area by about an acre.
25–VI–21	13,794	4,963	8,088	
2–VII–21	16,776	5,331	8,227½	
9–VII–21	7,617	3,658	6,593½	
16–VII–21	4,876	1,893	3,403½	
23–VII–21	2,402	1,021	2,003	
30–VII–21	793	464	844½	End of season.

[1] Gough, H. L. Nature of damage done by Pink Boll-worm. *Bulletin No. 2, Entomological Section, Cairo* (1916).

Plate XVII. fig. 2 shows the same thing in graphical form, calculated in percentages. From this it will be seen that the percentage of locks destroyed is roughly $\frac{1}{3}$ of the percentage of bolls attacked for the first or season picking, and approximately half for the *kar* picking. From this it follows that for the *kar* picking not only are more bolls actually attacked but also the amount of damage done is proportionately greater for the amount of infestation. Plate XVII fig. 2 also gives the loss due to *Earias*, but that will be referred to again later.

The total number of bolls damaged by *Platyedra* for the season picking was 31.873, out of 1,75,284 bolls collected, that is to say, 12·47 per cent. Out of these 31.873 bolls, with an average of 3·6 locks each (the number of locks in a Cambodia boll varies from 3–5), *i.e.*, 114,741 locks, 36,812 were damaged, that is to say, approximately 33 per cent. of the bolls damaged were a total loss. This makes the damage due to the Pink Boll-worm for the season picking about 4 per cent. As stated above, this figure is, of course, only approximate and represents the maximum loss. It is not claimed that this figure would hold good for the whole Presidency or even for the district as in some parts of Coimbatore the infestation is always lower than on the Central Farm.

For the *kar* picking it was found that the actual loss is a little less than $\frac{1}{2}$ of the percentage infestation. In view of the increase in the boll-worm population as the season progresses some such result might have been expected. For the *kar* picking 57,228 ripe bolls were collected. Of these 22.247 or 39·95 per cent. were damaged by Pink Boll-worm. The 23,857 bolls represent 82,285 locks. Of these 38,622 locks were damaged—this represents 10,728·3 bolls = total loss of 18·7 per cent. or approximately a little less than half the total green boll infestation. The great difference between the loss in the season crop and the *kar* crop is very noticeable. If the *kar* picking is taken as 40 per cent. of the total picking this would mean a loss to the whole crop of 11 per cent. which is probably a fair estimate. It does not however take into account the losses due to *Earias*, or to premature bud-fall due both to *Earias* and to other causes.

A few notes were made on the amount of the food required by one *Platyedra* larva to complete its development. These notes were made in the following way. Attacked bolls were opened and examined seed by seed, the number of seeds totally destroyed was noted, and every escape hole cut was taken as an indication that a larva had been in the boll. The results are tabulated below :—

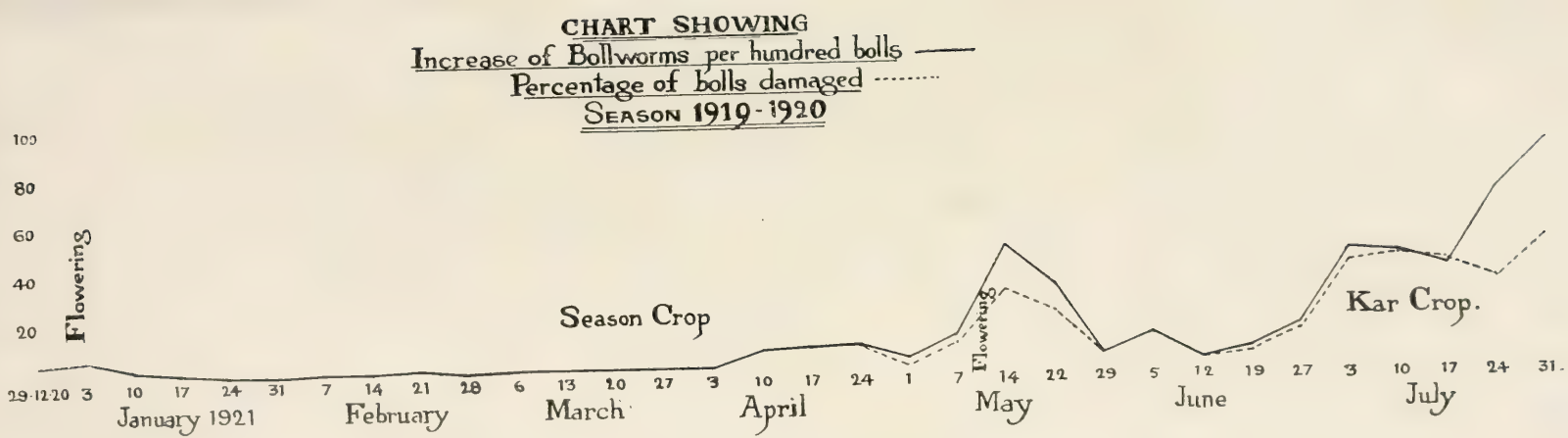


Fig. 1.

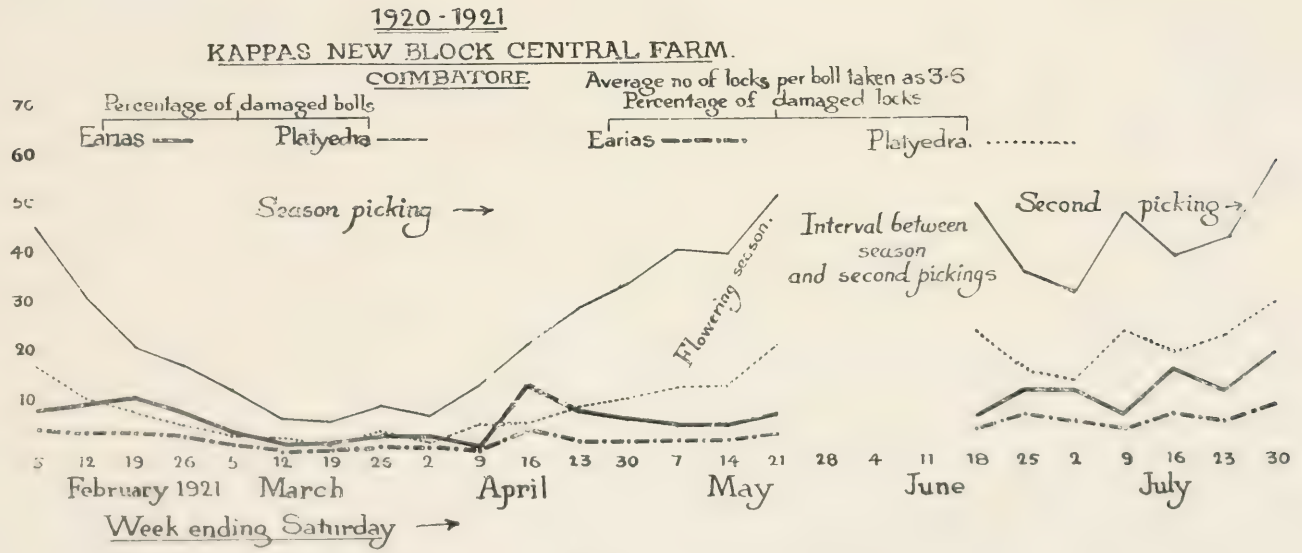


Fig. 2.

PLATE XVII.

TABLE IV.

Showing the amount of food required by Platyedra larva for development.

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
1	1 + 10 mm. 1 + 5 mm.	2	4	+	
2	1 + 5 mm.	1	2	–	
3	..	1	4	+	
4	..	1	3	+	2 seeds only nibbled.
5	..	1	3	+	
6	..	1	6	+	
7	2 — 5 mm.	2	2	—	
8	..	2	7	+ (2)	
9	..	3	6	+ (2)	
10	1 + 10 mm.	1	4	—	
11	2 + 10 mm.	2	4	—	These larvæ measured exactly 10 mm.
12	..	1	7	+	
13	2 + 10 mm.	2	4	+	
14	1 + 10 mm.	1	4	—	
15	..	2	5	+	
16	1 — 5 mm.	1	2	—	
17	2 — 5 mm.	1	2	—	
18	1 — 5 mm.	3	9	+ (2)	*Earias* had also damaged this boll.
19	1 + 10 mm.	1	5	+	
20	..	2	6	+	
21	1 + 5 mm.	2	2	—	
22	1 + 10 mm.	1	6	+ (2)	
23	1 + 10 mm.	2	7	+	
24	1 + 5 mm.	½	2	—	One seed only nibbled.
25	..	1	2	+	
26	..	1	3	+ (2)?	*Earias*

TABLE IV—*contd.*

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
27	..	½	2	+	
28	..	2½	5	+ (2)	
29	1 + 10 mm.	½	1	.	No staining of *kapas*.
30	..	2	5	+ (2)	
31	..	1	4	+ (2)	Also damaged by *Earias*.
32	..	1	2	+	Lock entirely destroyed.
33	1 + 5 mm.	½	1	..	
34	..	3	9	+	Larva had entered from the top of the boll and although over 5 mm. in length had been feeding on boll wall and had only just began to attack the seed. It was feeding free in the lint.
35	..	1½	8	+	
36	..	1	2	+	
37	1 + 10 mm.	2	5	+	Larva measured exactly 10 mm.
38	..	½ + ½	3	+	
39	..	..	..	..	Boll undamaged by larva making cocoon on bracts.
40	..	1	4	+ (2)	
41	1 + 10 mm.	1	5	+	
42	..	½	1 ? 2	+	Boll attacked by Saprophytic fungus.
43	..	1½	4	+3	
44	1 + 10 mm.	1	4	+	
45	1 + 10 mm.	½ + ½	5	+	Larva had made a cocoon by rolling up a leaf in the cage.
46	..	1	1	+	Boll only half-grown.
47	1 + 10 mm.	½ + ½	3	+ (2)	Two holes in two different locks. In one locule two seeds damaged, in the other fully fed larva inside a seed. Suggested that 2nd "Escape hole" was an entrance hole. This in my opinion is very doubtful.
48	..	½ + ½	4	+ (2)	One seed eaten in one locule, two in another.

TABLE IV *contd.*

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
49	1 + 10 mm. 1 + 5 mm.	½+½+½	5	+ 2	3 seeds eaten in one locule, one in each of the others.
50	1 + 10 mm. 1 + 5 mm.	½ + ½	4	–	3 seeds eaten in one locule, one in each of the others. The small larva had eaten through the septum dividing two locks.
51	..	½ + ½	5	+ (2)	
52	..	½ + ½	4	+ (2)	
53	1 + 10 mm.	All	..	+ (2)	Boll was ½ in diameter and completely destroyed.
54	..	2	5	+ (2)	
55	..	½ + ½	2	+ ? 2	Doubtful whether one or two larvæ had been in hole. But probably only one.
56	1 + 10 mm.	..	4	+	One escape hole half-made, one complete.
57	..	..	5	+ 2	
58	..	..	..	–	*Earias* eating boll rind.
59	1 + 10 mm. 1 — 5 mm.	2	4	–	3 seeds eaten by larva.
60	2 + 5 1 + 10	3	9	+ 4	One lock attacked by fungus.
61	1 + 5	2	2	+ (2)	
62	..	4	6	+ 3	
63	1 + 10 3 + 5 1 — 5	3	9	+ 2	
64	1 + 10 10 — 5	3	9	+	
65	1 + 10 mm.	2	6	+ 2	
66	1 + 5 mm.	1	2	+ 2	
67	6 (-5) mm.	3	6	+	
68	1 (5) mm.	2	3	+	

TABLE IV—*contd.*

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
69	1 (+ 5) 3 (+ 10)	3	6	+	Whole boll destroyed by *Earias* ?
70	1 + 10 3 + 5	2	6	+	+ 10 larva parasitized ; escape hole half-made.
71	1 + 5	1	2	—	
72	1 (+ 10)	3	9	+ (3)	Larva parasitized.
73	..	4	8	+ (3)	
74	1 + 10	4	6	+	Locks all partially damaged. Larva parasitized.
75	1 + 10 1 + 5	4	6	+ (2)	
76	1 + 5	1	2	—	Seeds attacked but not eaten entirely.
77	..	..	..	—	Attacked by bacteria.
78	1 + 10 1 + 5	3	8	+ (2)	
79	..	..	..	—	Unidentified larva had eaten a large hole from base of boll. No damage inside.
80	..	½ + ½	4	+ (2)	
81	..	1	4	+	
82	1 + 10 1 — 5	2	7	+ (2)	
83	..	All locks showed damage	10	+ (4)	
84	damaged by fungus	4	..	+	
85	..	1	1	+	
86	..	1	..	..	Whole of one lock destroyed either by *Earias or Platyedra.*
87	..	1	8	+	Two seeds were only damaged above the side.

TABLE IV—*concld.*

Serial No.	No. and size of larvæ	No. of locks damaged	No. of seeds damaged	Escape holes	REMARKS
88	..	2	5	+ (2)	Two seeds entirely destroyed; 3 nibbled seeds completely eaten, each at the top of a locule.
89	..	½ + ½	2	+	
90	..	..	..	—	Small *Earias* just boring in.
91	..	3	8	+ (2)	
92	..	..	..	—	Young *Earias* tunnelling in boll wall.
93	..	1	2	+	
94	..	1	8	+ (2)	Badly attacked by Saprophytic fungus.
95	..	2	4 ? (5)	+	
96	2 +5 mm.	3	10	+ (4)	Do.
97	..	1	4	+	
98	1 +5 mm. 2 +10 mm.	..	..	—	Lost count of seeds.
99	1 —5 mm.	2+½+½	..	+	One larva found just under 5 mm. tunnelling in lint but had not damaged any seed.
100	..	1	3 + 1	..	One damaged by *Earias*.
101	..	1	6	+ (2)	
102	..	½	2	+	Saprophytic fungus in boll.

224 larvæ had destroyed partially or entirely 356 seeds. Of these larvæ 51 were recently hatched or only half-grown. So it would appear that not more than three seeds are required to feed a larva. The average would be about 2, provided that the boll was fairly well-grown at the time of attack. As has been often stated before, *Platyedra* usually avoids young bolls. In this connection it might be noted that *Platyedra* early in the season lays its eggs on flowers and prefers apparently those blooms which are fertilized and beginning to wither. Recently laid eggs were found in fertilized flowers on 17-XII-20. The first boll-worms were not found in bolls until the week ending 1-I-21. At the time when eggs were found on the flowers there were young maturing bolls in the field, but not in any great number (Table I).

Examination of seeds and bolls for the existence of long-cycle larvæ.

Green bolls were collected from the Central Farm on 2-VIII-21. These gave 1,118 moths between 2-VIII-20 and 4-IX-20 of which the great majority came out by 25-VIII-20. In addition to these, two were caught on 10-IX-20.

These bolls were examined on 28-I-21 ; many seeds showed pupal cases either inside them or half pushed out of the hole made by the entrance of the larva. No larvæ were found with the exception of one which was dead.

The remainder were examined on 1-III-21. One double seed was found containing a dead larva. one or two seeds with no larvæ and numerous pupal cases.

There seems to be little doubt that long-cycle larvæ do not occur in South India.

Kapas store Central Farm Summer picking, 1920.

Between 16-VII-20 and 15-VIII-20 a light trap was put in the *kapas* store on the Central Farm. Between 16-VII-20 and 15-VIII-20, 1,335 moths emerged, the highest catch being 138 on 30-VII-20. No more were caught after that date and the store was cleared from *kapas* and seed purchased locally, probably mixed first and second picking. Between 16-X-20 and 2-XI-20, 62 moths emerged, the highest catch on any day being three.

Comparison of attack by *Platyedra* in area under the Pest Act and areas outside its jurisdiction.

The Pest Act was extended in 1920 to cover all Coimbatore District with the exception of Kollegal, Trichengode in Salem District, Karur, Kulitalai and Manaparai in Trichinopoly District, and the *taluqs* of Dindigul and Periakulam in Madura District. All Cambodia cotton was supposed to be pulled up by 1st August. This ideal was not attained but all cotton was out by the end of the month except in those cases where false returns had been submitted.

Arrangements were made with the Deputy Directors of Agriculture to send in weekly consignments of green bolls from different places in their circles. Some 100–300 bolls were sent weekly. The results of the examinations of these bolls are given below (Table V) :

TABLE V.

(A) *Infestation of bolls from Pest Act area.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual Population *Platyedra*	Per cent. *Earias*	Population *Earias*	REMARKS
Coimbatore District. Avanashi Taluq.						
26-II-21	207	1·96	3	1·44	..	All cotton pulled up after the first picking.
5-III-21	102	3·92	3	·98	..	
12-III-21	103	0·97	..	..	..	
19-III-21	105	6·60	1	1·90	..	
26-III-21	120	6·60	3	4·10	2	
2-IV-21	189	8·31	8	1·14	1	
9-IV-21	110	16·36	8	2·72	..	
16-IV-21	115	30·43	34	2·60	1	
23-IV-21	110	50	42	2·72	1	
30-IV-21	107	41·12	79	4·67	..	
7-V-21	100	43	54	1·00	..	
14-V-21	106	70·75*	287	1·88	2	
Coimbatore District, Palladam Taluq.						
19-II-21	116	12·06	6	0·86	1	
26-II-21	349	7·26	29	2·24	1	
5-III-21	323	6·40	23	0·98	2	
12-III-21	208	6·70	9	..	..	
19-III-21	422	7·28	10	2·57	4	
26-III-21	212	7·96	9	0·81	1	
2-IV-21	303	9·38	24	2·77	2	
9-IV-21	287	18·86	42	4·04	1	
16-IV-21	289	33·90	106	3·75	4	
23-IV-21	204	41·66	69	9·8	4	
30-IV-21	208	49·12	186	2·38	..	
11-VI-21	101	24·75	15	0·99	1	
25-VI-21	103	17·47	8	6·79	6	
2-VII-21	95	16·84	3	..	..	
9-VII-21	108	39·87	21	5·55	2	Average for Coimbatore District including Central Farm 19·09.

Average infestation for season 19·9 per cent.

* As the season picking is over by this date and there are very few green bolls it is doubtful whether this figure should be included in the average.

TABLE V—*contd.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual population *Platyedra*	Per cent. *Earias*	Population *Earias*	REMARKS
			Madura District, Dindigul Taluq.			
12-III-21	96	22·91	33	3·12	1	Bolls from Dindigul and Palani mixed in transit.
19-III-21	50	38·00	33	2	1	
26-III-21	100	24·00	17	5	..	Boll also attacked by *Platyedra.*
2-IV-21	160	36·91	79	0·5	..	One lot of bolls a long time in transit.
9-IV-21	101	70·29	102	2·97	2	
16-IV-21	104	26·29	18	25·96	9	
7-V-21	100	36·00	30	..	..	
14-V-21	101	86·13*	198	2·97	6	
21-V-21	101	37·62	27	..	..	
27-V-21	97	30·92	26	..	..	
4-VI-21	190	46·00	60	..	..	
25-VI-21	99	13·13	5	..	..	
2-VII-21	100	18·5	40	..	..	
9-VII-21	99	58·58	68	..	..	Excluding week 14-V-21 which was abnormal owing to there being very few bolls in the fields from which consignments were collected.
			Madura District, Nilakottai Taluq.			
11-VI-21	100	39	48	2	2	
18-VI-21	100	56	85	3	3	
			Palani Taluq.			
12-III-21	96†	22·91	33	3·12	1	
19-III-21	50	58·00	24	8·00	4	
28-V-21	109	46·78	47	1·83	1	
			Periakulam Taluq.			
12-III-21	99	5·05	3	3·03	2	
19-III-21	101	12·87	2	3·96	4	
26-III-21	100	14·00	13	4·00	1	
9-IV-21	100	48·00	61	6·00	2	
16-IV-21	101	27·72	16	27·72	5	
14-V-21	98	85·71‡	196	8·16	4	
28-V-21	100	29·00	43	2·00	2	
11-VI-21	75	40·00	14	4·00	1	
18-VI-21	100	25·00	18	9·00	7	
2-VII-21	98	30·61	21	6·12	1	

Average infestation for whole season for this *taluq* 45·89 per cent.

The average for the season for these *taluqs* of Madura District in which the Pest Act was enforced is 39 per cent.

* Picking over, very few bolls in those fields. They do not therefore represent an average attack.

† Bolls from Palani and Dindigul *taluqs* which adjoin were mixed in transit.

‡ Picking over in this field, bolls very few.

TABLE V. *contd.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual population *Platyedra*	Per cent *Earias*	Popu lation *Earias*	Remarks
			Salem District, Omalur Taluq.			
26–III–21	107	0·93	..	3·73	3	
2–IV–21	109	36·69	43	2·74	2	
			Salem Taluq.			
26–III–21	100	..	..	6·00	1	
12–III–21	110	10·9	4	2·72	2	
			Trichengode Taluq.			
26–II–21	105	1·9	2	..	..	

Average for Salem District 3·85 for months February and March.

			Trichinopoly District, Karur Taluq.			
9–IV 21	119	36·13	65	2·52	..	These bolls were collected from fields in which picking was in progress. In the vicinity the crop had been removed before May. These figures are not reliable therefore and could not be included when making out general average for area under Pest Act.
21–V–21	250	80·00	202	3·60	3	
			Kultialai Taluq.			
26–III–21	100	4·0	2	13·0	7	Only consignment received from this part.

An examination of a crop was made in this *taluq* in the middle of August. Infestation was 10 per cent.

			Musuri Taluq.			
2–VII–21	167	34·13	63	2·99	..	Only consignment received from this *taluq*

(B) *Bolls from* Taluqs *not under the Pest Act.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual population *Platyedra*	Per cent. *Earias*	Popu lation *Earias*	Remarks
			North Arcot District.			
12–III–21	203	49·75	53	1·97	1	
26–III–21	140	25·71	14	0·70	1	
30–IV–21	106	8·49	1	2·83	..	

TABLE V.—*concld.*

Date	No. of bolls examined	Per cent. infestation *Platyedra*	Actual population *Platyedra*	Per cent. *Earias*	Population *Earias*	REMARKS
			Vellore—North Arcot.			
5-III-21	195	5·04	4	26·15	23	Cambodia cotton only recently introduced.
19-III-21	201	11·44	2	..	..	
30-IV-21	200	32·50	27	4·00	2	
			Madura District, Tirumangalam Taluq.			
12-III-21	200	32·50	30	2·00	6	
19-III-21	200	41·00	131	2·00	13	
26-III-21	200	42·00	108	2·50	10	
2-IV-21	200	48·50	207	3·00	1	
9-IV-21	199	50·25	29	1·05	1	Some larvæ eaten by ants in transit.
16-IV-21	200	32·50	53	0·17	3	
23-IV-21	189	64·02	273	0·52	..	
30-IV-21	200	74·50	424	0·50	1	
7-V-21	200	61·00	171	2·50	5	
14-V-21	200	68·00	191	3·50	..	
21-V-21	195	38·97	49	6·66	1	
28-V-21	200	36·50	61	4·00	..	
4-VI-21	200	29·00	11	3·50	1	
11-VI-21	201	8·45	3	3·98	2	
18-VI-21	200	17·00	4	6·00	..	
25-VI-21	200	14·50	11	6·50	1	
2-VII-21	200	20·50	17	5·00	3	
9-VII-21	200	41·50	62	1·50	..	

Average infestation for season 40·03.

Unfortunately a complete series of bolls was only obtained from one *taluq* outside the Pest Act area. The figures might however be compared with those from the same districts last year when the Pest Act had been enforced only in Coimbatore District.

Date	Area	Attack in 1920	Attack in 1921
		per cent.	per cent.
17-VII-20	Virudupatti, Ramnad District	42·9	34–40
3-VII-20	Dindigul tract	80·9	18·5
5-VI-20	Salem	68·0	No details for this month.

Coimbatore District, where the Pest Act has been enforced since 1919 but which showed boll infestation of 75–84 per cent. in that year, at the end of the season in 1920 showed a maximum of 55·5 per cent., and in 1921 a maximum of 41 per cent. From these figures, although they are not by any means as complete as might be desired, it may be concluded that the pulling out

of Cambodia by a certain date, so as to leave a definite dead season between each crop has been attended by satisfactory results. At Tiruppur, the great cotton ginning and buying centre in Coimbatore District, the opinion of buyers is unanimous that the quality of the cotton since the introduction of the Act has improved. They are all in favour of its being continued. The details of boll infestation not being a complete series from every *taluq*, for purposes of comparison one should select certain weeks and compare them with the same week in other districts and with the same district in previous years.

The actual application of the Act is by no means as satisfactory as could be desired. They are only too many factors calculated to nullify the good effects of its strict enforcement. False returns are sent in stating that all cotton has been pulled up when that is not the case. Sometimes fields sown with Cambodia are not shown in the village accounts, especially if the owner is rich or influential. There is much delay in pulling out the cotton even when it is pulled out and, except in the case of irrigated cotton, it is very rarely that it is out by the appointed date, 1st August. In time, when both the *raiyats* and the Village Officers are accustomed to the Act, its application will be much more efficient. In addition to trouble with the Village Officers there is the usual difficulty created by alarmists who spread wonderful tales as to the real motives which inspired the Act. For example, certain helpful persons, non-co-operators, put it about that the idea of the Act was to restrict the growing of cotton, and to discourage the *raiyats* so that no home spun and woven cloth could be used. The *raiyats* would thus be forced to buy imported cloth. Others had an idea that by pulling up cotton by 1st August plague would be prevented. Others again thought the Government wished to prevent cotton being grown, and there is no doubt that the area of Cambodia cotton was much reduced in some places in consequence. The *raiyat* appears to find it difficult to believe that any Act could be brought in for his own benefit and there are only too many people going about nowadays ready and anxious to provide him with some other theory of the idea underlying the Pest Act, the "Satanic Government" being credited with all kinds of wicked motives!

In spite of all this the continued strict enforcement of the Act is necessary. It may have to be amended in some ways to suit peculiar conditions in different areas. In a country where consideration and mercy are almost invariably looked upon as weakness great care has to be exercised in giving concessions by extending the date by which the crop must be out of the ground so that, when a certain date has been decided upon for a particular tract, the provisions of the Act should be enforced with the utmost vigour. On the whole it cannot be said that the Act is popular with the *raiyats*, but as the majority of them

cannot be expected to know what is good for them, the fact of its unpopularity should not prevent its continuance.

Only one examination of Karunganni cotton (*Gossypium obtusifolium*) was made this year. This was from a field on the Central Farm. 200 green bolls contained 4 larvæ and a 3·5 per cent. infestation. The examination was made on 25-VI-21, when fields of Cambodia were attacked 24–30 per cent.

Earias insulana and Earias fabia.

The numbers of *Earias* spp. in a field at a given time are always very much less than those of *Platyedra gossypiella*. At the same time, an individual *Earias* larva does far more damage than does a Pink Boll-worm. *Earias* larvæ wander from boll to boll, destroy buds and young bolls, and by the holes they make in grown bolls when they attack them, provide an entrance for fungi and bacteria. If *Earias* were as prevalent as *Platyedra* it would be a very serious pest indeed. As it is, in spite of the damage done to buds, tops, shoots and bolls, I do not look on it as a pest of the first order except in certain parts of the Presidency, *e.g.*, in Tinnevelly, where it is a much more serious pest than *Platyedra*.

Table VI shows the relative increase and damage done by *Earias* spp. on the Central Farm during 1920–21.

Plate XVI, fig. 2 shows the same thing in graphical form.

Table VI.

Green bolls from 100 plants.

11-XII-20—23-VII-21.

Plot No.	No. of bolls collected	Per cent. of bolls damaged	No. of larvæ found	Date	Remarks
1	35	34·28	7	11–XII–20	
6	104	4·90	5	18–XII–20	
12	76	5·25	4	25–XII–20	
18	205	2·92	4	1–I–21	
24	178	9·56	10	8–I–21	
30	209	4·78	9	15–I–21	
36	405	6·33	16	22–I–21	
42	770	3·37	4	29–I–21	
48	862	1·50	..	5–II–21	
54	556	2·33	7	12–II–21	
60	709	0·84	6	19–II–21	
66	354	0·84	1	26–II–21	
72	343	1·45	3	5–III–21	
78	235	0·85	1	12–III–21	
84	340	2·64	8	19–III–21	
90	169	1·77	2	26–III–21	

TABLE VI. *concld.*

Plot No.	No. of bolls collected	Per cent. of bolls damaged	No. of larvæ found	Date	Remarks
96	255	7·05	16	2-IV-21	
112	84*	11·9	6	9-IV-21	105* : Bolls collected, some eaten by
118	65*	18·46	12	16-IV-21	118* : rats.
124	101	23·76	18	23-IV-21	
130	114	12·28	11	30-IV-21	
136	124	8·06	7	7-V-21	
142	148	6·08	7	14-V-21	
148	148	3·39	7	21-V-21	
154	869	7·94	48	28-V-21	
160	1,412	4·10	58	4-VI-21	
166	604	12·25	52	11-VI-21	
172	343	18·07	51	18-VI-21	
178	377	21·48	44	25-VI-21	
184	593	7·41	28	2-VII-21	
190	300	11·33	26	9-VII-21	
196	104	18·66	12	16-VII-21	
202	108	17·59	10	23-VII-21	

TABLE VI A.

Damage done in dry ripe bolls at the time of picking.

Date	No. of bolls gathered	Bolls damaged by *Earias*	Locks damaged by *Earias*	Remarks
		Season Picking.		
5-II-21	10,023	825	1,643½	
12-II-21	8,528	821	1,293	
19-II-21	8,596	942	1,376	
26-II-21	13,328	1,123	1,783½	
5-III-21	26,904	1,085	1,379½	
12-III-21	25,604	287	348	
19-III-21	22,469	464	486	
26-III-21	11,664	346	338	
2-IV-21	8,609	222	233½	
9-IV-21	5,340	51	61	
16-IV-21	10,598	1,427	1,746½	
23-IV-21	4,643	360	481	
30-IV-21	8,050	451	678½	
7-V-21	3,688	197	279½	
14-V-21	3,547	194	288	
21-V-21	3,698	258	421	
		Kar *picking season.*		
18-VI-21	10,970	779	1,500	
25-VI-21	13,794	1,500	3,444½	
2-VII-21	16,776	2,001	3,295	
9-VII-21	7,617	581	1,122	
16-VII-21	4,876	775	1,313	
23-VII-21	2,402	270	503½	
30-VII-21	793	140	251	

Percentage of dry bolls damaged for season picking .. 5·16
,, ,, ,, *kar* ,, .. 10·90

Actual damage .. 12736·5 locks = 3536·8 bolls = 2·01% season picking.
,, ,, 11427 ,, = 3063 ,, = 5·3 % *kar* ,,

From this it will be seen that damage done by *Earias* is approximately half the green boll infestation as compared with one-third for *Platyedra* for season picking and half for *kar* picking.

On the same basis, taking season picking to be 60 per cent. of the total picking and if the figures for the Central Farm are more or less typical for the District, *Earias* damaged 3·32 per cent. of the total crop compared with 11 per cent. loss due to *Platyedra* or 14 per cent. loss of the crop due to both boll-worms.

All the above figures deal with bolls which had set and ripened. *Earias* does most havoc among buds and very young bolls, and also to the top shoots of the plants, causing in some cases much deformity. In Table VII are given the figures for the number of bolls and buds shed by 100 plants in one plot (No. 86) during the season.

TABLE VII.

Buds and bolls shed by 100 plants in Plot No. 86.

Date* week-ending	No. of buds and young bolls	Damaged by *Platyedra*	Damaged by *Earias*	Other than insect agency	REMARKS
11-XII-20 ..	81	..	67	14	The great majority of bolls were young ones of maximum diameter 5 cm.
18-XII-20 ..	66	1	58	7	
25-XII-20 ..	43	..	21	22	
1-I-21 ..	16	4	2	10	
8-I-21 ..	38	2	20	16	
15-I-21 ..	66	4	49	13	
22-I-21 ..	101	3	28	70	
29-I-21 ..	387	3	10	374	
5-II-21 ..	328	5	3	320	
12-II-21 ..	319	3	3	313	
19-II-21	336	3	7	320	

TABLE VII—*contd.*

Date week-ending	No. of buds and young bolls	Damaged by *Platyedra*	Damaged by *Earias*	Other than insect agency	REMARKS
26–II–21 ..	204	1	8	195	Figures for buds and young bolls given separately after this date.
5–III–21 ..	Buds 13	..	4	9	
	Bolls 72	..	4	68	
12–III–21 ..	Buds 26	..	1	25	
	Bolls 85	..	..	85	
19–III–21 ..	Buds 27	..	2	25	
	Bolls 114	..	15	99	
26–III–21 ..	Buds 21	4	5	12	
	Bolls 94	3	24	67	
2–IV–21 ..	Buds 25	1	3	21	
	Bolls 203	..	13	90	
9–IV–21 ..	Buds 3	..	..	3	
	Bolls 54	..	8	46	
16–IV–21 ..	Buds 26	1 ?	11	14	
	Bolls 37	1	12	24	
23–IV–21 ..	Buds 5	..	2	3	
	Bolls 6	1	2	3	
30–IV–21 ..	Buds 19	..	9	10	
	Bolls 34	4	2	28	
7–V–21 ..	Buds 76	13	33	30	
	Bolls 96	16	17	63	
14–V–21 ..	Buds 81	2	55	27	
	Bolls 211	7	107	97	
21–V–21 ..	Buds 125	33	79	13	
	Bolls 515	52	258	205	
28–V–21 ..	Buds 65	..	38	27	
	Bolls 550	20	116	414	
4–VI–21 ..	Buds 58	8	27	23	
	Bolls 414	9	81	324	

TABLE VII—*concld.*

Date week-ending	No. of buds and young bolls	Damaged by *Platyedra*	Damaged by *Earias*	Other than insect agency	REMARKS
11-VI-21 ..	Buds 28	12	12	4	
	Bolls 106	10	20	76	
18-VI-21 ..	Buds 10	1	6	3	
	Bolls 45	5	18	22	
25-VI-21 ..	Buds 5	1	2	2	
	Bolls 38	5	11	24	
2-VII-21 ..	Buds 4	..	4	1	
	Bolls 3	..	2	..	
9-VII-21 ..	Buds 30	1	29	..	
	Bolls 26	8	17	..	
16-VII-21 ..	Buds 87	10 ? *	73	4	
	Bolls 42	1	33	8	
23-VII-21 ..	Buds 45	2	41	2	
	Bolls 23	..	22	1 ?	

* Probably damaged by young *Earias*.

During the season the hundred plants in Plot 86 shed 4,168 bolls and buds. Of these shedding of 991 was due to *Earias* attack and 258 to *Platyedra* of which 11 are doubtful. The remainder dropped owing to bacterial infection or purely physiological causes (Plate XVIII).

SUMMARY.

1. Figures obtained this year seem to indicate that the actual loss sustained by a cotton crop from *Platyedra* during the season picking is $\frac{1}{3}$ of the boll infestation and during the *kar* picking $\frac{1}{2}$.

2. *Earias* is a much less important pest although one larva does more damage than one *Platyedra* larva.

3. Loss due to *Earias* may be roughly estimated at $\frac{1}{2}$ the boll infestation.

4. Examination of entire crop from a field about 4 acres showed the loss due to Pink Boll-worm to be 11 per cent. and *Earias* spp. 3 per cent.

CHART SHOWING

Relative percentages of causes leading to bud and boll fall.
From 100 plants in plot No 86. New Block Central area. Central Farm. Coimbatore.
SEASON 1920-1921

Rainfall in inches = ——
Earias ..... = ---·---
Platyedra. = ...
other causes. bacterial or fungoid = ——

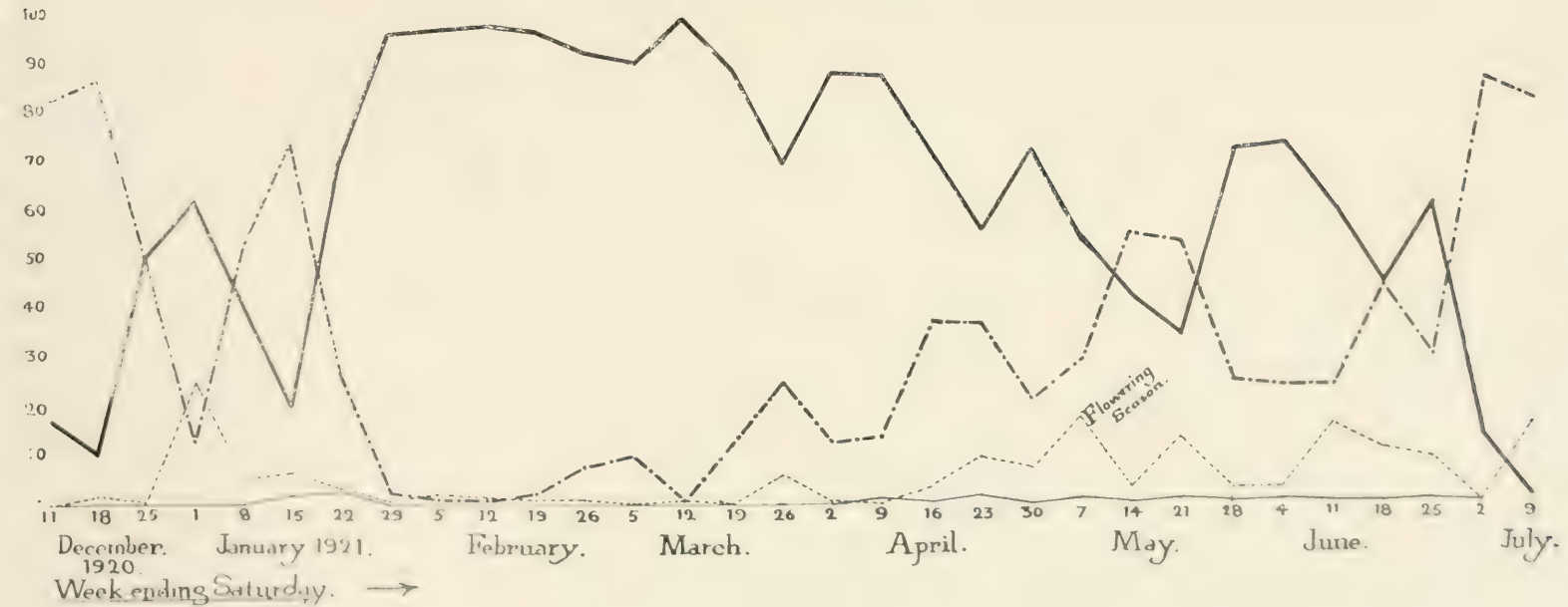


PLATE XVIII.

5. The enforcement of the Pest Act has been attended by good results and should be continued.

6. Figures are given showing how much bud and young boll shedding is due to *Earias* and *Platyedra*.

7. Figures are also given which show that one *Platyedra* larva needs one to three seeds to complete its development.

8. The "long-cycle" *Platyedra* larvæ do not occur in South India.

9. The increase in green boll infestation on Central Farm and in various districts is shown in the tables.